

Transit Competitive Index

Version 3

User Guide

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INTRODUCTION

Local jurisdictions, communities and neighborhood stakeholders need to understand how changes to conditions effect the competitiveness of transit in specific locations or travel markets. For example:

- What would happen if a new housing development is built in a neighborhood?
- How would the closing of a large employer affect transit ridership?
- What happens if toll prices are increased?
- How is transit competitiveness affected by traffic delays?

To aid this understanding, the Transit Competitive Index (TCI) tool v 3.0 developed by Cambridge Systematics, Inc. is designed to predict how competitive transit is for a given area and why.

Incorporating many of the conditions that contribute to successful transit service at an Origin (production), Destination (attraction), or Origin-Destination pair, this transit competitiveness is expressed as a TCI number, a quantitative measure representing the potential for transit ridership. The higher the TCI, the more competitive a market is for transit and the higher its potential for generating transit ridership.

High TCI due to...		Design Transit Service that...
Trip density at the Origin	⇒	Has convenient Stops at the Origin
Trip density at the Origin	⇒	Has convenient Stops at the Destination
Parking Cost	⇒	Has transit fares competitive with parking costs
Congestion	⇒	Operates independent of congestion (signal priority, queue jump lanes, dedicated ROW)
Work + College Trips	⇒	Focuses on peak period commute
All trips	⇒	Focuses on all-day transit availability

TCI supports the notion that transit can both define and respond to market conditions under a “livable cities” approach. The competitiveness work addresses both the attraction of good transit and the “push” of sustainable mobility policies.

Background

The TCI algorithm uses multiple inputs to the origin, destination and origin-destination pair:

- *Origin*. Trip intensity; pedestrian environment; auto access; walk distances; wait times; trip purposes.
- *Origin-Destination*. Congestion; transit priority; distance; travel time; transfers; time of day; transit fares
- *Destination*. Trip intensity; pedestrian environment; auto egress; walk distance; parking search time; parking cost

These factors are weighted by the ability of the factor to generate transit trips.

The result is a calculated TCI that indicates how competitive transit is relative to auto, based on the entire transportation network rather than purely transit availability.

To provide a baseline, the calculated TCIs are normalized to the regional average so that a TCI of 100 is the dividing line between transit uncompetitiveness and competitiveness.

REQUIREMENTS

TCI is implemented as a rich internet application using Adobe Flex to provide a rich user experience with cross-browser compatibility, and improved response times.

To access TCI, you need:

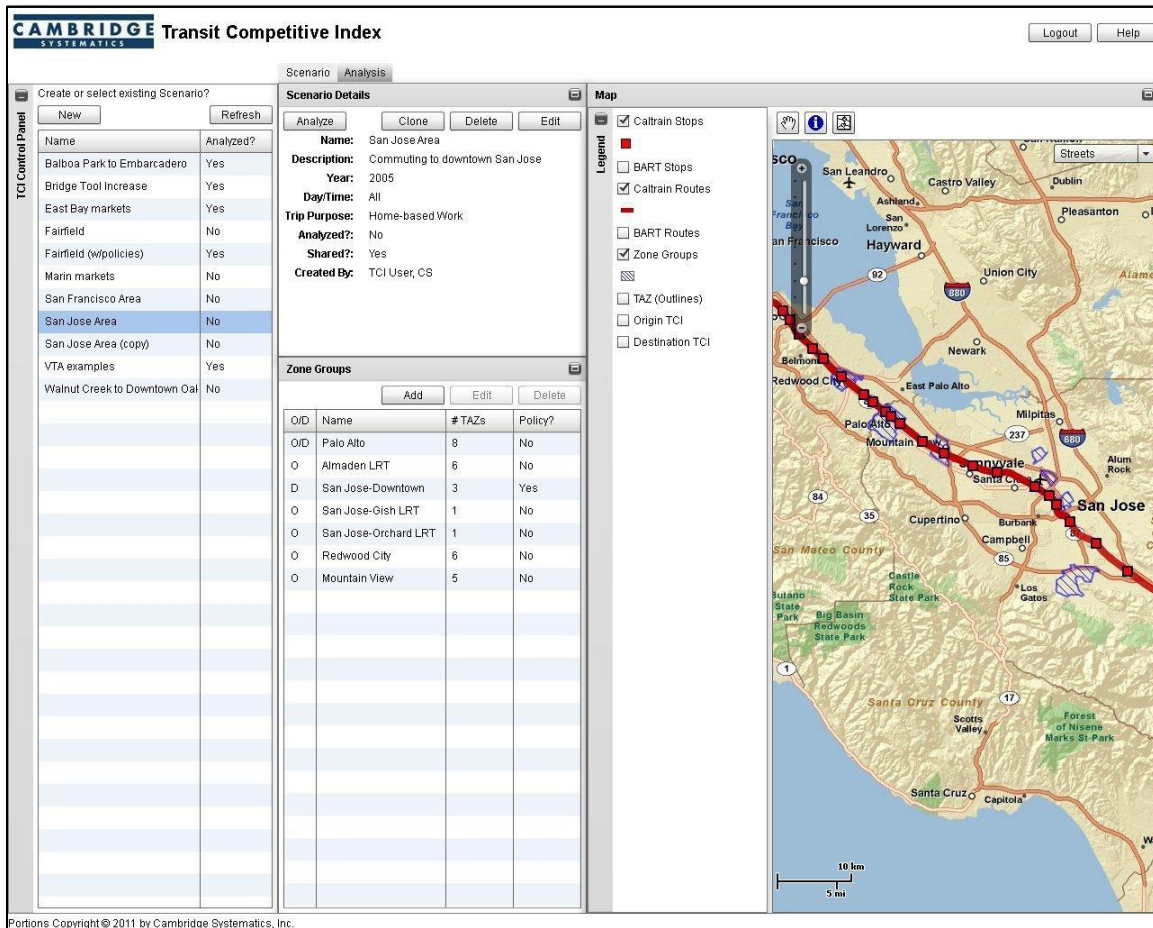
- A broadband internet connection;
- A standard internet browser with Adobe Flash Player v10.3 (or greater) installed; and,
- A valid username and password.



TCI will work correctly over a slower internet connect, however the speed of download and display of data will be severely impacted.

APPLICATION

The TCI application is designed around the concept of a Scenario, which encompasses general parameters, analysis year, trip purpose, and one or more Zone Groups with, optionally policies. Once a Scenario has been defined, it can be used to calculate the TCI for all defined Origin-Destination Zone Group pairs, both without and with the applied policies.



The TCI client application provides you with an intuitive interface to define and analyze a Scenario that is divided into 3 main area:

1. TCI Control Panel.
2. Scenario Tab.
3. Analysis Tab.

Each of these areas are described in detail below.



The windows with each of the areas can be minimize, restored and maximized by clicking the appropriate button in the top-right corner of the window.

TCI Control Panel

The TCI Control Panel manages the Scenario that is currently open within the application.

Create a New Scenario

A new Scenario needs to be created when you want to run analyze the transit competitiveness of a new set of Origin-Destination Zone Group pairs, and test how policy changes affect the competitiveness.

To create a new Scenario:

1. Click the 'New' button at the top of the TCI Control Panel.
2. The 'Scenario Parameters' dialog is display allowing you to set the parameters for the Scenario:

The 'Scenario Parameters' dialog box is shown with the following fields and values:

- Name: [Empty text box]
- Description: [Empty text box]
- Analysis Year: 2005 (dropdown menu)
- DayTime: All (dropdown menu)
- Trip Purpose: All (dropdown menu)
- Shared?: ☐
- Buttons: OK, Cancel

Name. Name of the Scenario.

Description. A general description of the purpose of the Scenario.

Analysis Year.

Trip Purpose. The purpose of the Trip (i.e., Home-based Work, Other, etc.).

Time of Day. The Time of Day (i.e., Peak Off-Peak, etc.) for the Scenario.

Shared?. Should a read-only version of the Scenario be visible to other TCI users outside of your group.

3. Click 'OK' to accept the parameters and create the Scenario.



By default, any TCI user within your group can view and edit any Scenario you create. If you want to share a read-only version of the Scenario with other TCI users outside of your group, check the 'Shared?' box.

Open an Existing Scenario

Over time, many different Scenarios can be created. These Scenarios can be re-opened, updated and re-analyzed. They are listed in the TCI Control Panel, together with an indication

whether they have previously been analyzed. You can simply re-open an existing Scenario by clicking upon the appropriate Scenario name.



You can copy or delete an existing Scenario by simply opening the existing Scenario and then clicking the 'Clone' or 'Delete' button in the Scenario Details window on the Scenario tab.

Refresh

During the regular use of TCI, Scenarios will be created, updated, analyzed and shared. Each of these operations can potential cause updates for the information shown in the TCI Control Panel. To update the panel

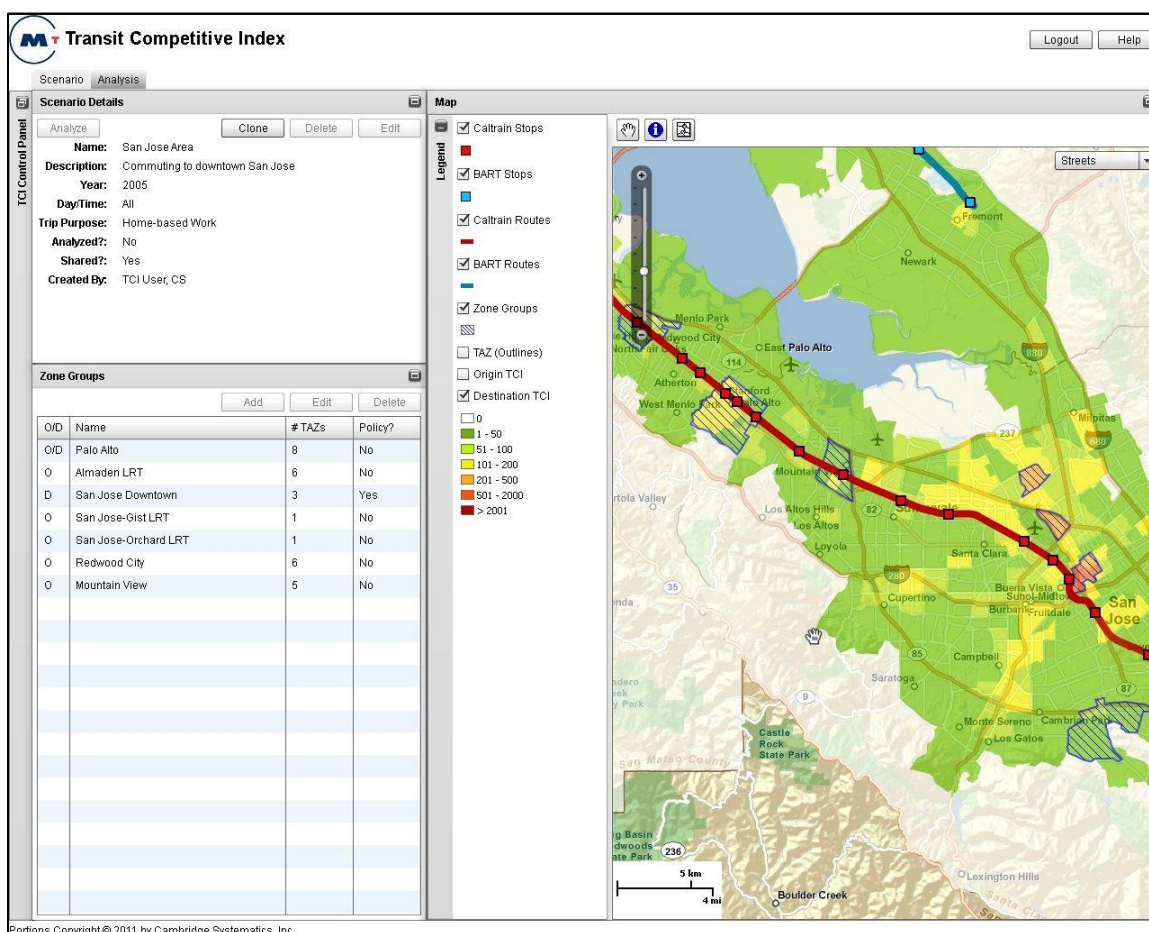
1. Click the 'Refresh' button at the top of the TCI Control Panel.

Scenario Tab

Each Scenario is composed of a number of different components:

4. General Parameters. Name, description, analysis year, and trip purpose.
5. Zone Groups. One or more Zone Groups aggregated from the underlying Traffic Analysis Zones (TAZ). The Zone Groups can be defined as Origin only, Destination only or Origin & Destination.
6. Policy. Optional policies applied to the Zone Groups.

The Scenario tab provides functionality to define and maintain all of these Scenario components.



The Scenario tab is split into 3 windows:

1. *Scenario Details*. Displays the general parameters related to the Scenario, together with providing the ability to analyze, edit, copy and/or delete the Scenario.
2. *Zone Groups*. Displays and maintains all of the Zone Groups defined within the Scenario.
3. *Map*. A map of the defined Zone Groups together with other reference data. Incorporates the ability to identify features on the map, and interactively select TAZs when defining a Zone Group.

Each of these components are described in detail below.

Map

The Map window shows, by default, a map of the whole area covered by the TAZs. Via this map, you can:

- Pan and zoom the map to any area.
- Change the map background.
- Overlay the TAZ and Zone Groups outlines.
- Overlay the default regional Origin and Destination TAZ TCIs.
- Overlay other reference layers, potentially including transit stops and routes.
- Identify any of the overlaid features.

Pan and Zoom the Map

To pan the map, make sure the 'Pan' tool is selected – the mouse-cursor will be a hand. If not, click the 'Pan' tool at the top of the map. Then click-and-drag the map in the required direction.

There are a number of different ways of changing the zoom level for the map:

1. Double-click the mouse pointer on the map. The map will zoom in by one level centered on the clicked point.
2. Move the pointer up and down the zoom bar. The map will zoom in or out to the selected zoom scale.
3. Click the '+' or '-' buttons at the top and bottom of the zoom bar. The map will zoom in or out by one level per click.
4. Scroll the mouse wheel. The map will zoom in (forward) or out (backward).



To zoom to the extent of the defined Zone Groups, click the 'Zoom to Scenario Extent' tool at the top of the map.

Change the Background

You can display several different map backgrounds, potentially including Streets, Satellite (aerial imagery), Hybrid (a combination of Streets and Satellite) or Physical (land relief).

To change the map background, simply select the required map background from the drop-down list in the top-right corner of the map.

Overlay Layers

Any of the layers listed in the legend panel on the left hand side of the map can be overlaid by checking the checkbox next to the layer name. Once checked, the layer is overlaid on the map and the color legend for the layer displayed in the legend panel.

To turn off a layer, uncheck the appropriate checkbox.

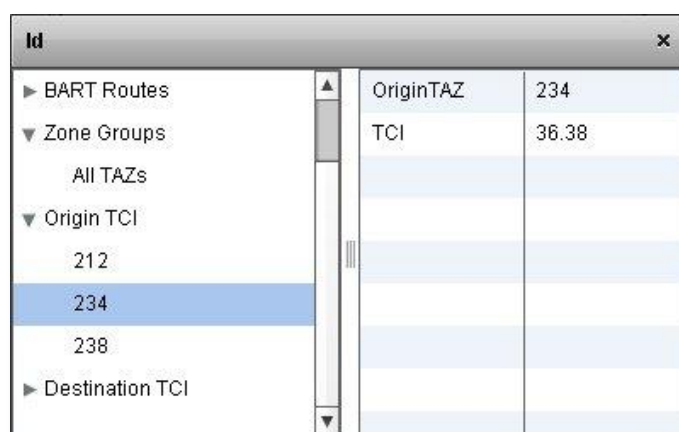


The TCIs displayed for the Origin TCI and Destination TCI related to the current Trip Purpose selected in the open Scenario.

Identify Features

TCI allows you to identify any of the features overlaid on the map and view the feature attributes.

1. Click the 'ID' tool at the top of the map.
2. Click the mouse-pointer on the feature(s) to identify. If at least one feature was located, the ID dialog is displayed.



3. The feature tree in the left panel lists all of the located features. Selecting any feature causes the attributes for that feature to be displayed in the right panel.
4. Click the 'X' in the top-right of the ID dialog to close the dialog.

Export the Map

An image of the displayed map can be exported for inclusion in another document (i.e., Microsoft Word document).

1. Make sure the Map window is maximized. If not, click the 'Maximize' button in the top-right corner of the Map window.
2. Click the 'Export' button, and follow the instructions.
3. If necessary, click the 'Restore' button in the top-right corner of the Map window to restore the Map window to the previous size.

Scenario Details

The general parameters that are used to define the Scenario, include:

- *Name*. Name of the Scenario.
- *Description*. A general description of the purpose of the Scenario.
- *Analysis Year*.

- *Trip Purpose*. The purpose of the Trip (i.e., Home-based Work, Other, etc.).
- *Time of Day*. The Time of Day (i.e., Peak Off-Peak, etc.) for the Scenario.
- *Shared?* Should a read-only version of the Scenario be visible to other TCI users outside of your group.

These parameters are displayed within the Scenario Details window together with an indication as to whether the Scenario has previously been analyzed.

Editing the Scenario Parameters

To update the parameters of the open Scenario, click the 'Edit' button in the Scenario Details window. The 'Scenario Parameters' dialog is displayed populated with the existing parameters.

Make all of the required changes and click 'OK'.

Copying the Scenario

If you want to take a copy of the existing Scenario to allow changes while retaining the original, click the 'Clone' button at the top of the window. An snapshot of the open Scenario is taken, given a new unique name and opened.

Deleting the Scenario

If you no longer want to save the open Scenario, click the 'Delete' button at the top of the window. After a confirmation dialog, the open Scenario will be deleted from the application and the default Scenario reopened.

Zone Groups

To be fully defined, a Zone Group must:

1. Have a unique Name.
2. Be defined as an 'Origin and Destination' (the default), 'Origin Only', or 'Destination Only'.
3. Reference one or more TAZs.
4. Optionally, have a policy defined.

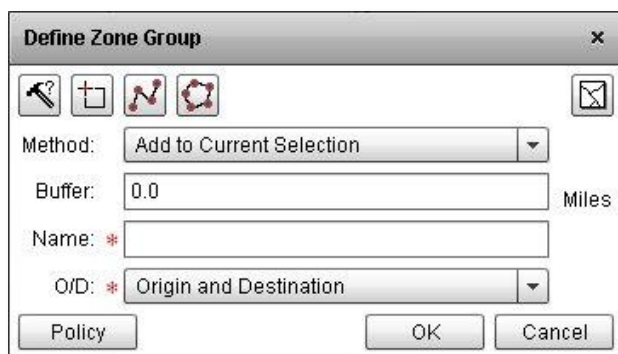
The Zone Groups window displays a list of all of the currently defined Zone Groups for the Scenario, including an indication:

- If the Zone Group is an 'Origin and Destination' (O/D), 'Origin Only' (O), or 'Destination Only' (D).
- How many TAZs have been merged to form the Zone Group.
- Whether the Zone Group includes a policy.



To view the list of TAZs that are referenced by a Zone Group, hover the mouse-pointer over the '# TAZs' column. The list of TAZs will be displayed in a pop-up window.

The creation and maintenance of the Zone Groups is performed via the 'Define Zone Group' dialog:

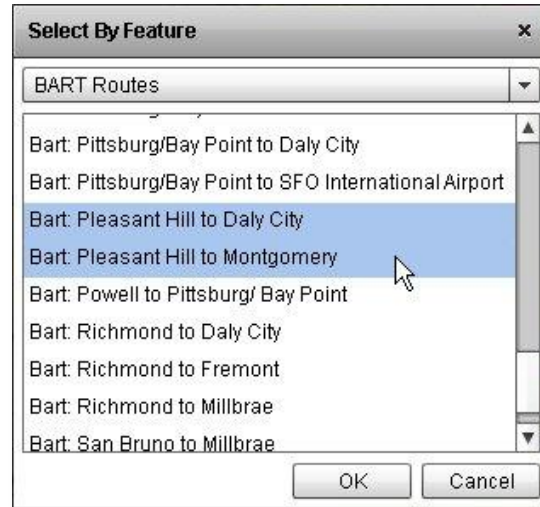


TAZ Selection

There are 5 basic functions of selecting TAZs which can be started by selecting the appropriate tool on the toolbar.

1. *Select by Feature*. This option allows you to select TAZs by selecting features of interest (i.e., TAZs, Bus Stops, Rail Routes, Counties, etc).

When selected, the 'Select by Feature' dialog is displayed. After a specific layer is chosen, all the features contained within the layer are displayed. Select one or more features.



All the TAZs that intersect the (buffered) selected features are selected.

2. *User Select*. This option allows you to select TAZs by clicking-and-dragging a rectangle on the Map. All TAZs that intersect the (buffered) rectangle are selected.
3. *Select by Polyline*. This option allows you to select TAZs by drawing a polyline on the Map. All the TAZs that intersect the (buffered) polyline are selected.
4. *Select by Polygon*. This option allows you to select TAZs by drawing a polygon on the map. All the TAZs that intersect the (buffered) polygon are selected.
5. *Clear Selection*. Selecting this option removes any current selection.

Selection Combination Methods

The current and new TAZ selections can be combined in 4 different ways:

1. *Create New Selection*. Discard the current selection and just highlight the new selection.
2. *Add to Current Selection*. Append the new TAZ selection to the currently selected TAZs.
3. *Remove from the Current Selection*. Remove any TAZs from the current selection that are also included within the new selection.
4. *Select from the Current Selection*. Only highlight TAZs that are contained within both the current and new selections.

Buffer

The Buffer selection of the 'Select Origins TAZs' dialog allows the drawn User Select rectangle, Polyline or Polygon, or the extent of the selected Features to be buffered by the defined distance before the TAZs are selected. This is useful if you wish to select all TAZs within 1 mile of a Route, or within ¼ mile of a subset of Bus Stops.

To set the buffer distance, enter the buffer size (in miles). This buffer will be used for all applicable selection operations until it is reset.

Policy

The database associated with the Analysis Year selected as part of the Scenario parameters is populated based on the results of a regional model, and uses certain assumptions related to population and employment distribution, commute costs and travel times. Hence, any analysis of the base Scenario will use these base results and assumptions.

To provide the ability to modify these assumptions and test how changes affect the competitiveness of an area, TCI allows a number of policies to be adjusted both for an individual Zone Group and for the region in general. Depending upon the policy, the changes can be entered as:

- *Percentage*. A percentage change to the existing policy.
- *Relative*. The existing policy value is adjusted by a fixed amount expressed in policy units.
- *Absolute*. The policy value is set to the entered value expressed in policy units.

To set a policy, simply:

1. Click the 'Policy' button on the 'Define Zone Group' dialog to display the 'Define Policy' dialog.

2. Enter the policy changes by selecting the policy change type and entering the policy value change. To reset a policy, simply select 'No change'.
3. Click 'OK' to accept the policy changes.



If you change any Scenario Level (i.e., regionwide) policy, this changes the policy for all defined Zone Groups. Zone Group Level policies only affect the current Zone Group.

Analyzing a Scenario

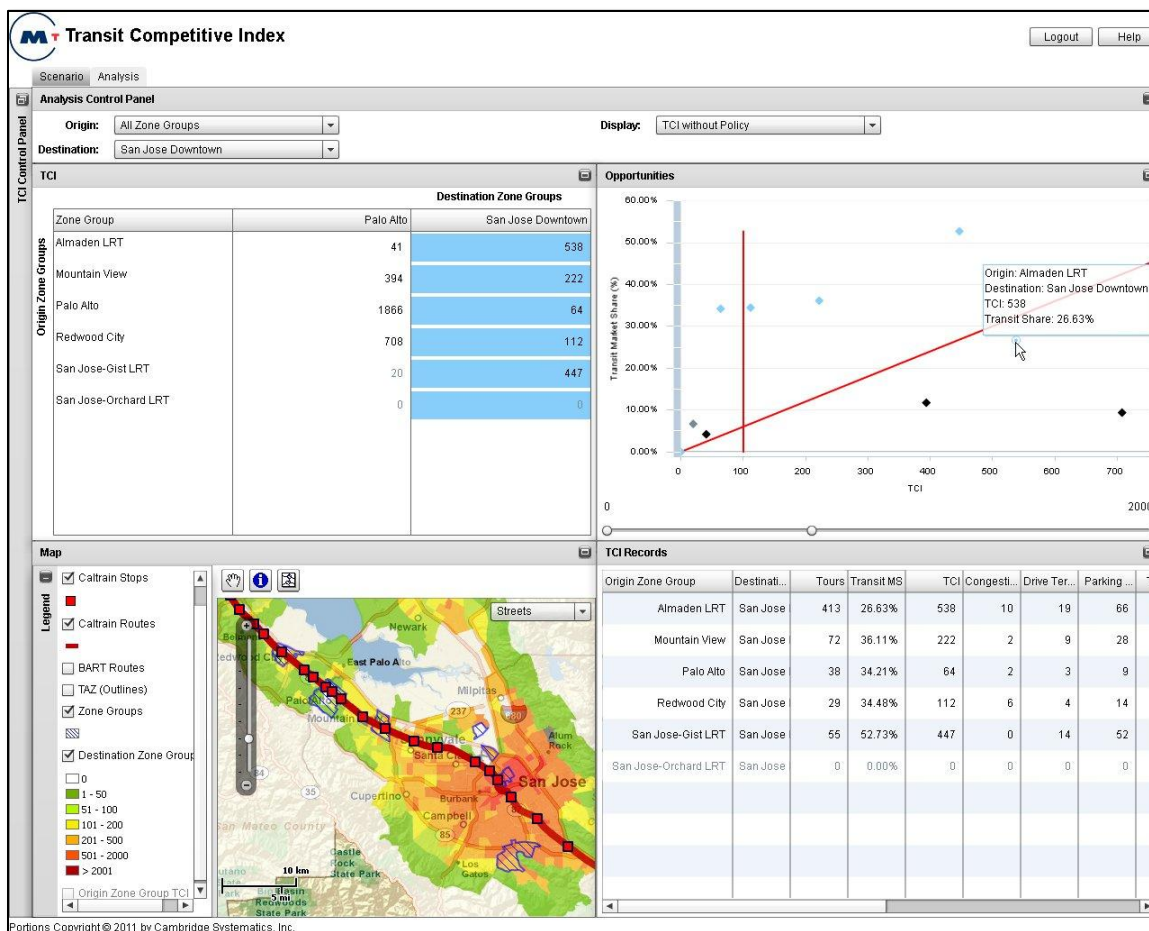
Once a Scenario has been fully defined, you can analyze it by clicking the 'Analyze' button in the 'Scenario Details' window. Depending upon the defined Zone Groups, it may take a few minutes to run the analysis. Once the analysis has been completed, the results can be displayed in the Analysis tab.

You can continue to use TCI while the analysis is being run. To check the status of the analysis, either:

1. Click the 'Refresh' button in the TCI Control Panel to update the 'Analyzed?' status
2. Click on the Analysis tab. If the results are available, they will be displayed otherwise a message is display asking you to return to the Scenario tab.

Analysis Tab

Once a Scenario has been defined, it can be analyzed to calculate the TCI for all defined Origin-Destination Zone Group pairs, both without and with the applied policies.



To aid in the comprehension of the Scenario analysis, the results can be filtered and displayed in a number of informative methods:

1. **Analysis Control Panel.** Provides the ability to focus the analysis results display for selected Origin and/or Destination Zone Groups, either without or with policy.
2. **TCI Crosstab.** A table showing the calculated TCI for all valid Origin-Destination pairs.
3. **Map.** A map showing the geographic area for the Scenario with, optionally, the TAZ-level TCIs for a selected Origin or Destination Zone Group.
4. **Opportunities Chart.** A scatter-plot of TCI plotted against existing percentage Transit Market Share for Origin-Destination Zone Group pairs attempting to highlight areas with untapped potential.
5. **TCI Records.** A table showing the component values for each Origin-Destination Zone Group pair that are combined to calculate the TCI.

Each of these components are described in detail below.

Analysis Control Panel

By default, the calculated TCIs for all Origin-Destination Zone Group pairs are displayed in the Analysis tab windows. The Analysis Control Panel allows you to select:

- An individual Origin or Destination Zone Group on which to focus the results.
- Whether to display the results without or with policies applied.

TCI Crosstab

The TCI Crosstab displays a matrix of the calculated TCIs for each valid Origin-Destination Zone Group pairs, where Origins Zone Groups are rows and Destination Zone Groups are columns.

If individual Origin and/or Destination Zone Groups are selected in the Analysis Control Panel, the associated calculated TCIs are highlighted in the TCI Crosstab.



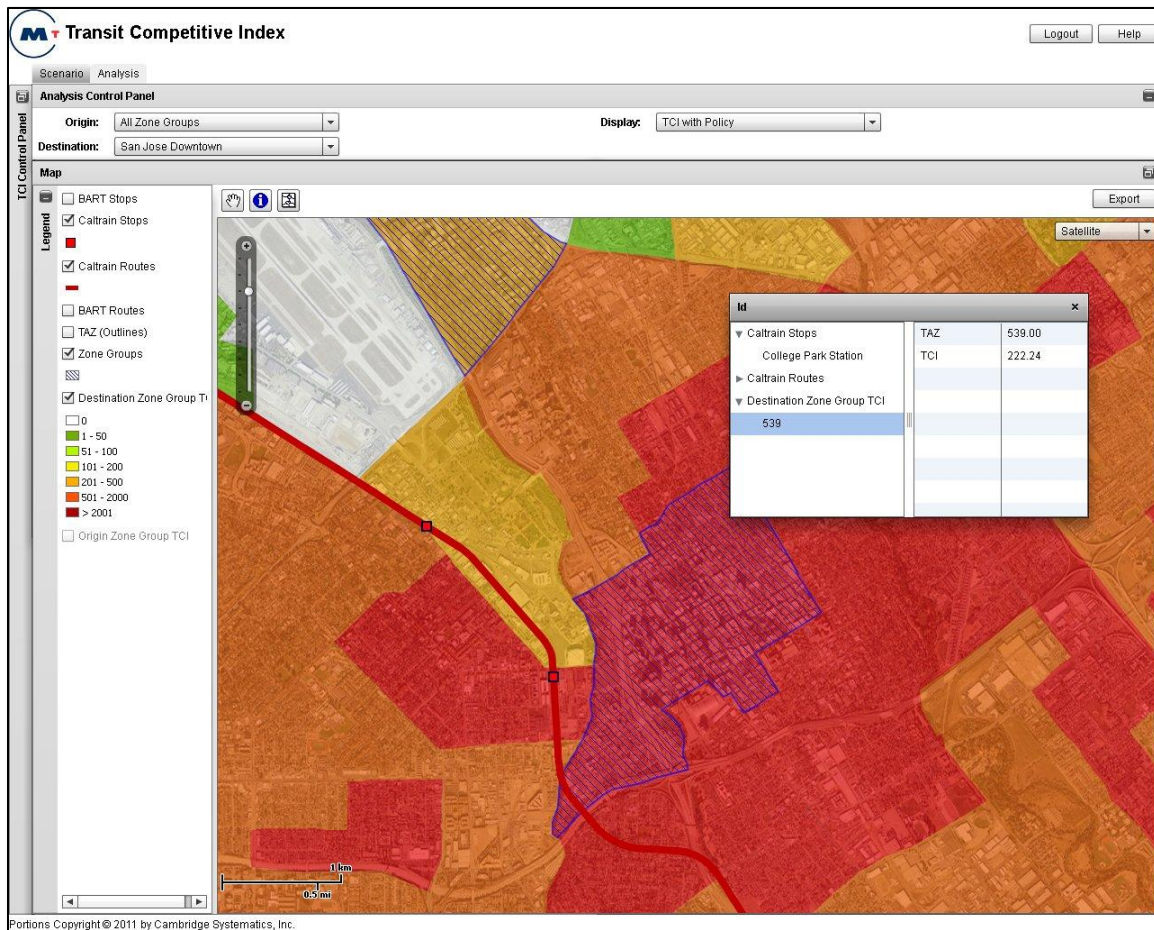
Statistically, unreliable results occur when only a few tours exist in a market. While the TCI application still displays the calculate TCIs for Origin-Destination Zone Group pairs with limited number of tours, the TCI numbers are displayed in a lighter color to differentiate them.

Within the crosstab, you can:

- Sort the table alphabetically by clicking on the column header. Click the column header again to reverse the sort order.
- Change the column order by clicking on the column header and dragging the column horizontally left or right.
- Click the 'Export' button (available when the window is maximized) to export all of the records to a Comma Separated Values (.csv) file that can be opened in Microsoft Excel.

Map

The Map window allows you to display the results of the analysis spatially.



In addition to inheriting all of the functionality contained in the main Scenario map, the Analysis map allows you to display the TAZ-level TCIs for a selected Origin or Destination Zone Group. To display:

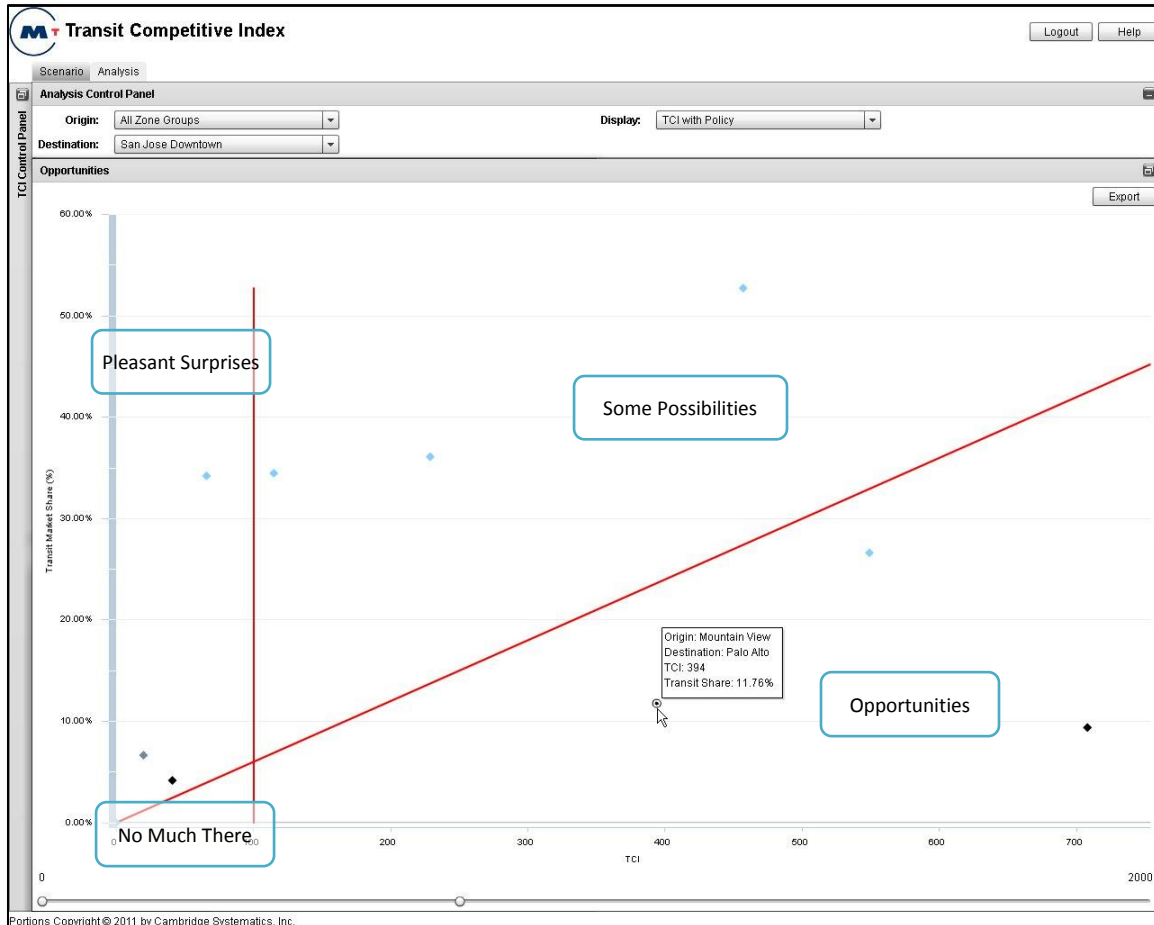
1. Select the appropriate Origin or Destination Zone Group via the Analysis Control Panel. This enables the appropriate Origin or Destination Zone Group TCI layer in the map legend.
2. Turn on the layer to display the TAZ-level TCIs on the map



To export the map to an image file, make sure the window is maximized and simply click the 'Export' button.

Opportunities Chart

One of the primary purposes of TCI is to aid in the identification of potentially underserved markets. These markets can clearly be visualized via the Opportunities Chart, where calculated TCI for each Origin-Destination is plotted against the existing percentage Transit Market Share.



The chart is divided into 4 areas:

1. *Not Much There*. Both low TCI and low percentage Transit Market Share provide very little potential.
2. *Pleasant Surprises*. A relatively high percentage Transit Market Share despite a low calculated TCI show there are other factors driving transit usage.
3. *Some Possibilities*. There is already an existing correlation between percentage Transit Market Share and TCI, but policy changes could still improve transit ridership.
4. *Opportunities*. The calculated TCI indicates high transit potential that is not being currently met.

It is Origin-Destination Zone Group pairs that are plotted in the 'Opportunities' area, and to a lesser extent the 'Some Possibilities' area, that should be focused upon.

Within the chart, you can:

- Zoom into a specific TCI range using the slider below the chart. As the minimum or maximum TCI is changed, the chart will automatically adjust.
- Mouse-over one of the Origin-Destination Zone Group pair scatter points to display the percentage Transit Market Share and TCI.
- Click the 'Export' button (available when the window is maximized) to export the chart to an image file.



If specific Origin and/or Destination Zone Groups are selected in the Analysis Control Panel, the associated scatter points are highlighted.

TCI Records

The calculated TCI is comprised of a number of factors that are weighted by the ability to generate trips. These factors are displayed in the TCI Records table.

M+ Transit Competitive Index

Scenario Analysis

Analysis Control Panel

Origin: All Zone Groups
Destination: All Zone Groups
Display: TCI with Policy

TCI Records

Origin Zone Group	Destinati...	Tours	Transit MS	TCI	Congestion	Drive Ter...	Parking C...	Toll Cost	Auto Avail...	Househol...	Destinati...	Destinati...	Destinati...	Origin La...	Product...	Attraction...
Almaden LRT	Palo Alto	240	4.17%	41	3	2	3	0	-7	0	0	0	0	0	0	25
Almaden LRT	San Jose C	413	26.63%	549	10	19	79	0	-57	1	0	147	1	0	17	387
Mountain View	Palo Alto	680	11.76%	394	5	16	22	0	-12	0	0	0	1	0	50	257
Mountain View	San Jose C	72	36.11%	229	2	9	33	0	-2	0	0	52	0	0	31	141
Palo Alto	Palo Alto	3099	13.36%	1866	1	49	100	0	448	7	0	0	4	0	181	1188
Palo Alto	San Jose C	38	34.21%	66	2	3	11	0	9	0	0	19	0	0	9	45
Redwood City	Palo Alto	852	9.39%	708	7	29	40	0	-39	0	0	0	2	0	239	426
Redwood City	San Jose C	29	34.48%	115	6	4	17	0	-5	0	0	26	0	0	28	67
San Jose-Gist LRT	Palo Alto	15	6.67%	20	1	0	1	0	2	0	0	0	0	0	-13	8
San Jose-Gist LRT	San Jose C	55	52.73%	457	0	14	62	0	28	4	0	96	1	0	-226	318
San Jose-Orchard LRT	Palo Alto	0	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0
San Jose-Orchard LRT	San Jose C	0	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0

Export

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The table shows one record per selected Origin-Destination Zone Group pair.



Statistically, unreliable results occur when only a few tours exist in a market. While the TCI application still displays the calculate TCIs for Origin-Destination Zone Group

pairs with limited number of tours, the row is displayed in a lighter color to differentiate them.

Within the table, you can:

- Sort the table alphabetically by clicking on the column header. Click the column header again to reverse the sort order.
- Change a column width by selecting the divider between 2 column headers and dragging left or right.
- Change the column order by clicking on the column header and dragging the column horizontally left or right.
- Click the 'Export' button (available when the window is maximized) to export all of the visible records to a Comma Separated Values (.csv) file that can be opened in Microsoft Excel.